



AMPEX

SP-600

Wideband Instrumentation Recorder
1 KHz to 1.5 MHz

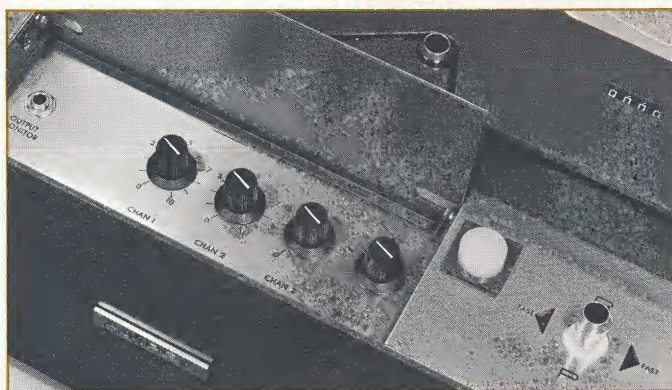


The Ampex SP-600 is a compact, low cost instrumentation recorder designed for wideband direct recording applications where more expensive and sophisticated systems are not needed. Four channels are provided on ¼-inch tape using a direct recording technique with a frequency response of 1 KHz to 1.5 MHz. This covers a wide range of instrumentation recording applications including laboratory use.

The SP-600 design emphasizes ease of operation and serviceability, with primary operating controls conveniently grouped to centralize the operation. Recording time is 19 minutes with a 12½-inch reel (11,500 feet).

SP-600 Features

- Lowest priced 1.5 MHz recorder/reproducer available.
- Easily transportable. Weighs only 120 lbs.; 3.6 cu. ft.
- All solid state, no warmup required.
- Handles 0.5 mil tape for longer run time. 19 minute maximum.
- Built-in tape cleaners to minimize drop-outs.
- Lower tape costs—SP-600 tape costs only 59% of ½ inch tape.
- Dual capstan drive assures proper, positive tape-head contact.
- Complete remote control if desired.



Separate record level controls for each channel

Typical applications for the SP-600:

- Pulse analysis of fast rise time transient information which would be lost on narrower bandwidth recorders.
- Research concerned with pulse analysis on variable high rate data such as would be obtained from a scintillation counter.
- Recording pre-detection type signals in the field or in the laboratory as a backup for more elaborate equipment.
- Radar training through playback of previously recorded exercises or simulated situations.
- Recording of wideband multiplexed data such as a multiple channel telephone carrier group.



Wide opening head cover for easy access

ELECTRONICS

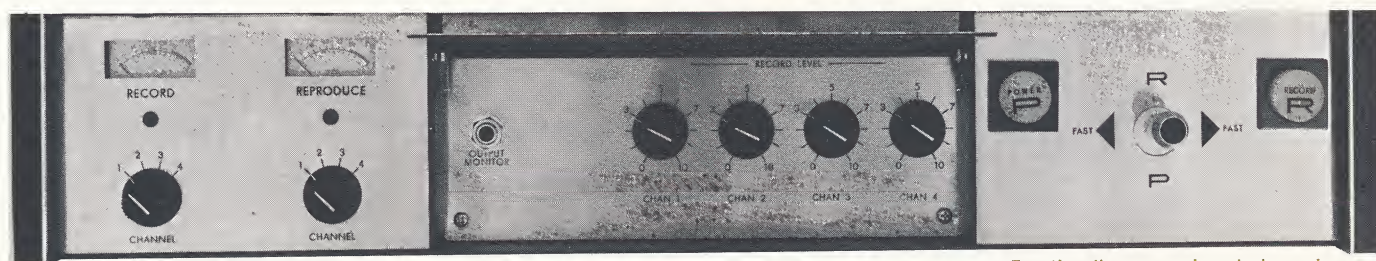
Each of the four signal channels has an input level control accessible from the front of the transport. Also, the record and reproduce monitor meters and associated channel selector switches are located on the front panel. If external monitoring is required, there is an output monitor jack. Input and output connectors are located at the rear of the transport. Convenient remote operation of the SP-600 system is accomplished with the local-remote switch and remote jack. The signal electronics are plug-in circuit boards, four record amplifiers and four reproduce amplifiers.

The electronics tray swings out for easy access and service. Transport functions (record/reproduce, fast forward and rewind) are controlled by a single "joy stick" switch, and the possibility of

accidental recording is eliminated by the record interlock button which must be depressed when using record mode.

TAPE TRANSPORT

A one piece casting has been utilized in the tape transport design to provide maximum rigidity. Built-in tape lifters and tape cleaners greatly increase both head and tape life. The reel rotation counter has a quick reset feature which returns all digits to zero with the push of a button. Head assemblies, with reproduce azimuth adjustment, are easily replaceable. The two record and two reproduce head stacks provide four precision interlaced tracks on the ¼ inch tape. Sensing arms provide automatic shut-off of the transport when the end of the tape is reached.



Functionally arranged control panel

SP-600 Performance Specifications

TAPE TRANSPORT

Run Time:	19 minutes with 12½" (31.8 cm) reel, 11,500 ft. (3,505 m).
Tape Speed:	120 ips. (304.8 cm/sec).
Reels:	The SP-600 tape transport accommodates either 12½" or 10½" Ampex Precision reels.
Tape Specifications:	½ mil ¼" polyester. The SP-600 is checked out using Ampex type 143 tape. Stated performance and warranty are guaranteed only when using Ampex recommended tape.
Start Time:	10 seconds or less.
Stop Time:	5 seconds maximum.
Fast Wind Time:	Approximately 7 minutes for 12½" reel, with 11,500 feet of tape.
Tape Speed Error:	±0.3% maximum.
Flutter:	Maximum cumulative flutter recorded and reproduced at speed indicated: below 0.5% peak-to-peak, cumulative from 0.2 Hz to 10 KHz at 120 ips.
Controls:	Joy stick, record, reproduce, forward rewind control; illuminated buttons for power and record interlock. Front panel input level controls for each of the four tracks.
Metering:	Record and reproduce monitor meters with suitable switching for each of the four channels. A jack is provided for external monitoring.

HEADS

	The head assemblies are easily replaceable units, the two reproduce head stacks have adjustable azimuth controls.
Track Dimensions:	Track width is .043"; track spacing .068".
Number of Tracks:	4 on ¼" tape.

1.5 MHz RECORD/REPRODUCE SYSTEM

Frequency Response:	±3 db 1 KHz to 1.5 MHz.
Harmonic Distortion:	(Normal record level): 1.0% third of a 10 KHz sinusoidal signal at the record tape speed.
Input Level:	1 volt rms nominal (0 dbv), to produce normal recording level; operable from 0.25 to 10 volts rms by adjustment of input potentiometer.
Input Impedance:	1,000 ohms, ±20%, 250 pF maximum, unbalanced to ground.
Output Level and Load:	1 volt peak-to-peak across 75 ohms, unbalanced to ground.
Signal-to-Noise Ratio:*	20 db (rms Signal to rms Noise) Bandpassed 1.0 KHz to 1.5 MHz with normal record level.

POWER REQUIREMENTS

Voltage:	117 volts.
Frequency:	60 cps single phase ac.
Current:	6.0 amperes.

ENVIRONMENT

	The SP-600 is designed for normal laboratory environment.
Mounting:	Horizontal.

PHYSICAL CHARACTERISTICS

Size:	Single cabinet: 23½" (59.7 cm) long by 17½" (44.5 cm) deep by 15" (38.1 cm) high.
Weight:	Approximately 120 pounds (54.43 kg).
Volume:	3.6 cu. ft. (.1 cu. m).

* Measured at the output of bandpass filter having 18 db/octave attenuation beyond limits stated.

Ampex Instrumentation Products for Every Application

	SP-300	FR-1300	CP-100	AR-200	FL-300	FR-1200	FR-1800L	SP-600	FR-1400	FR-1800H	FR-1600	AR-1600	FR-900	AR-500
Usage	Port.	Lab	Port.	Airborne	Lab	Lab	Lab	Lab	Lab	Lab	Lab	Air/Port	Lab	Airborne
Reel Diameter (inches)	7, 10½	10½	10½	10½	(Loop)	10½, 14	10½, 14	10½, 12½	10½, 14	10½, 14	10½, 14 15, 16	10½, 14	10½	8.2
Tape Speeds — 2:1 Steps (ips)	1⅞ - 15	1⅞ - 60	1⅞ - 60	1⅞ - 60	1⅞ - 60	1⅞ - 60	1⅞ - 120	120	1⅞ - 120	1⅞ - 120	3¾-240 ³	3¾-120 ³	12½	
Tape Width (inches)	¼, ½	½, 1	½, 1	½, 1	½, 1	½, 1	½, 1	¼	½, 1	½, 1	½, 1	½, 1	2	2
Number of Tracks	4, 7	7, 14	7, 14	7, 14	7, 14	7, 14	7, 14	4	7, 14	7, 14	7, 14	7, 14	1 ³	1 ³
Bandwidth, Direct, at Max. Speed	40 KHz	300 KHz	250 KHz	250 KHz	300 KHz	300 KHz	300 KHz	1.5 MHz	1.5 MHz	1.5 MHz	2.0 MHz	2.0 MHz	5.5 MHz	5.5 MHz
S/N — Direct at Max. BW (db)	30	32	32	32	32	32	32	20	26	28	20	20	38	40
S/N — 20KHz FM (db)	38 ¹	46	46	45	46	46	48		30	Note 5				
S/N — 400KHz FM (db)									30	32	30	30		
Time Displacement Error (μS)		±100				±250	±1.5		±250	±1.5	±.5	±2.0	±25 ⁴	±25 ⁴
Dynamic Skew (μS)							±0.2		±0.4	±0.2	±0.2	±.4		
Pulse Duration Modul. Available		yes	yes	yes		yes	yes		yes	yes				
Frequency Shift Modul. Available									yes	yes				
Digital (NRZ) Available			yes	yes										
Capstan Servo		yes				yes	yes		yes	yes	yes	yes	yes	yes
Weight — Lbs.	90	110	194	100	350	700	800	120	790	800	800	100	850	100

¹BW 2500 Hz

²180 ips available

³Two tracks available

⁴Nanoseconds

⁵40 and 80KHz FM available

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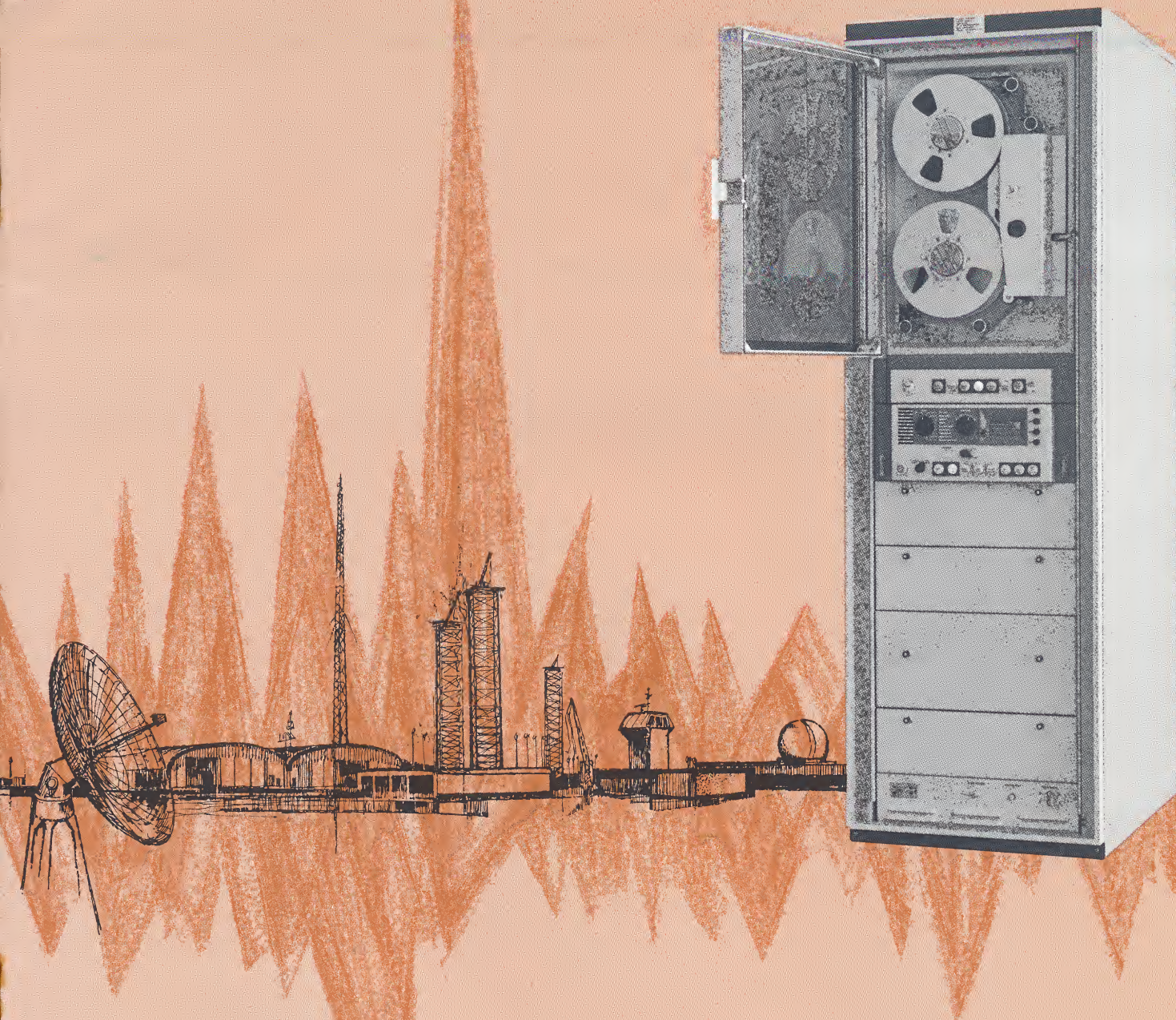
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Wideband

AMPEX

FR-900 5.5 Megacycle Recorder/Reproducer

Most Accurate Magnetic Tape Recorder Ever Produced

FR-900 WIDEBAND RECORDER

An Incomparable Combination: *Widest Bandwidth with Greatest Accuracy*

The Ampex FR-900 offers these outstanding advantages:

- 5.5 Megacycle Bandwidth
- Transient-Free Operation
- Time-Base Stability of ± 15 Nanoseconds Peak
- 630 HR MTBF (Computed)

Put the FR-900 to work in radar recording, communications monitoring, predetection recording, radio and radar astronomy or other advanced techniques. It delivers wideband accuracy unattainable in any other recorder.

Specifications are impressive even by Ampex standards. They include a 3-db bandwidth from 10 cps to 5.5 Mc (DC on special order), signal-to-noise ratio of 40 db peak-to-peak at full bandwidth, spurious signal 46 db or more below peak signal level, and a peak time-base stability of at least ± 15 nanoseconds, performance unmatched by any other recorder. For the complete story on the FR-900's outstanding specifications, consult Ampex publication.

Two Versions

Two recorder configurations are available: the transient-free, time-base-stabilized record/reproduce version, and a data acquisition version with a "quick-look" reproduce capability for on-site examination of recorded data. A plug-in components kit provides conversion from data-acquisition reproduce to time-base-stabilized reproduce. There is no loss or repetition of data in data reduction from any head switching process.

Standard Equipment

Standard equipment on each machine are components that provide long life, tightly controlled operation and easy monitoring. The 5.5 Mc wideband channel is augmented by two auxiliary data channels with their own separate head. Standard speed is 12.5 inches per second; slow search is the same. In addition, there is a high-speed search of 125 ips. The capstan servo is tachometer controlled. Electronics are all solid-state.

The built-in monitor bay, with integral oscilloscope and calibration facilities, makes on-the-spot calibration fast and simple. It includes all functions necessary for operations monitoring and routine system alignment. Microphone and speaker-amplifier are also built-in for recording of audio data on auxiliary channels.

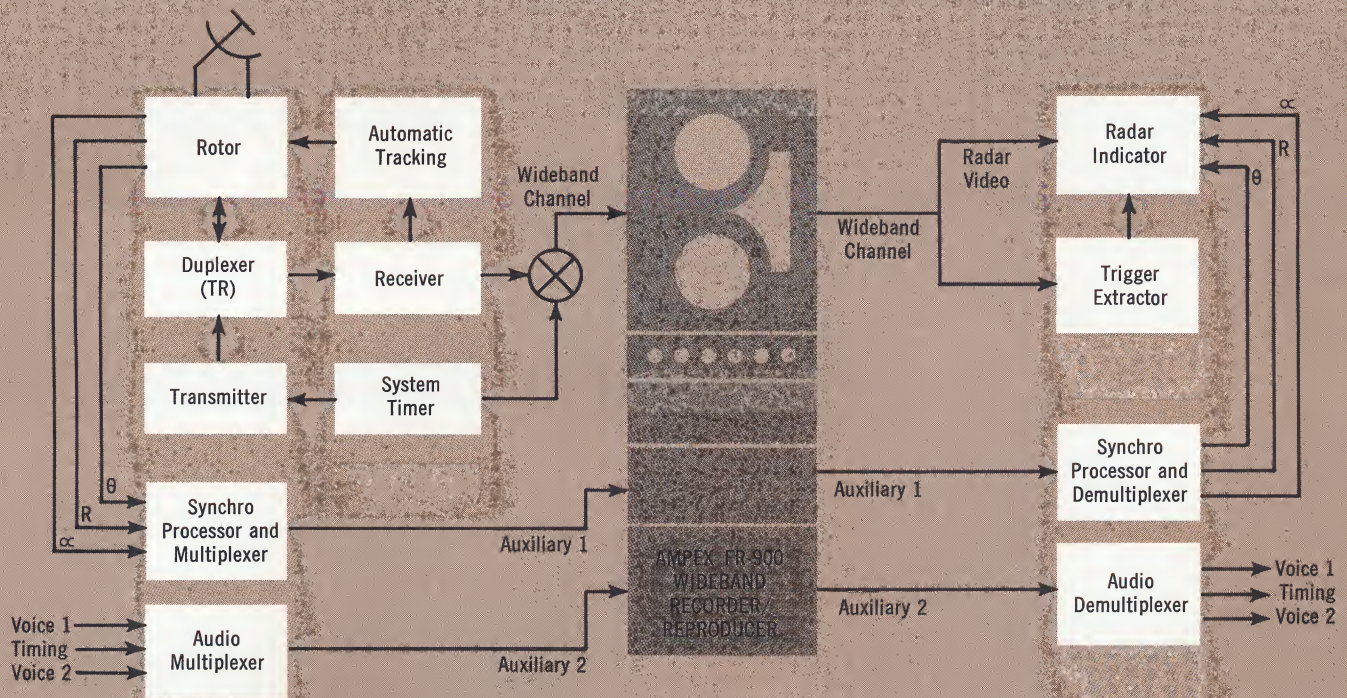
The wideband technology that Ampex has pioneered since 1956, with the introduction of the Videotape* television recorder, reaches its instrumentation perfection in the Ampex FR-900. This machine's capabilities and reliable performance provide the user who needs its special facilities with the best possible recorder the state of the art can produce.

*TM Ampex Corporation



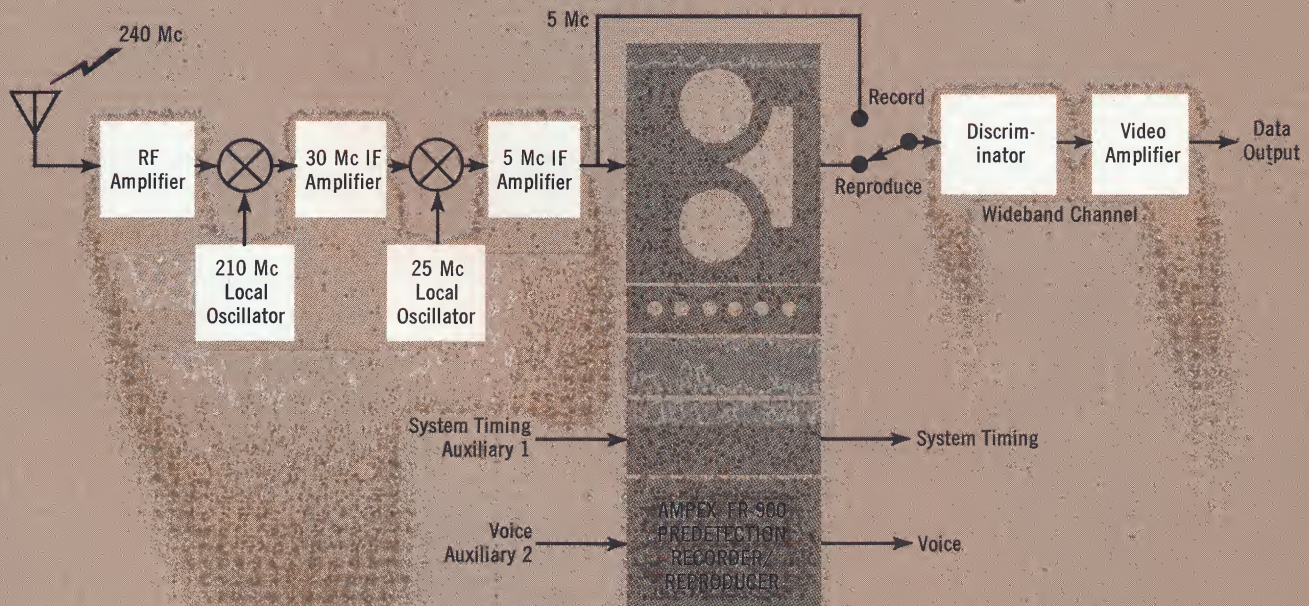
"Quick-look" version of FR-900

FR-900 APPLICATIONS



RADAR RECORDING

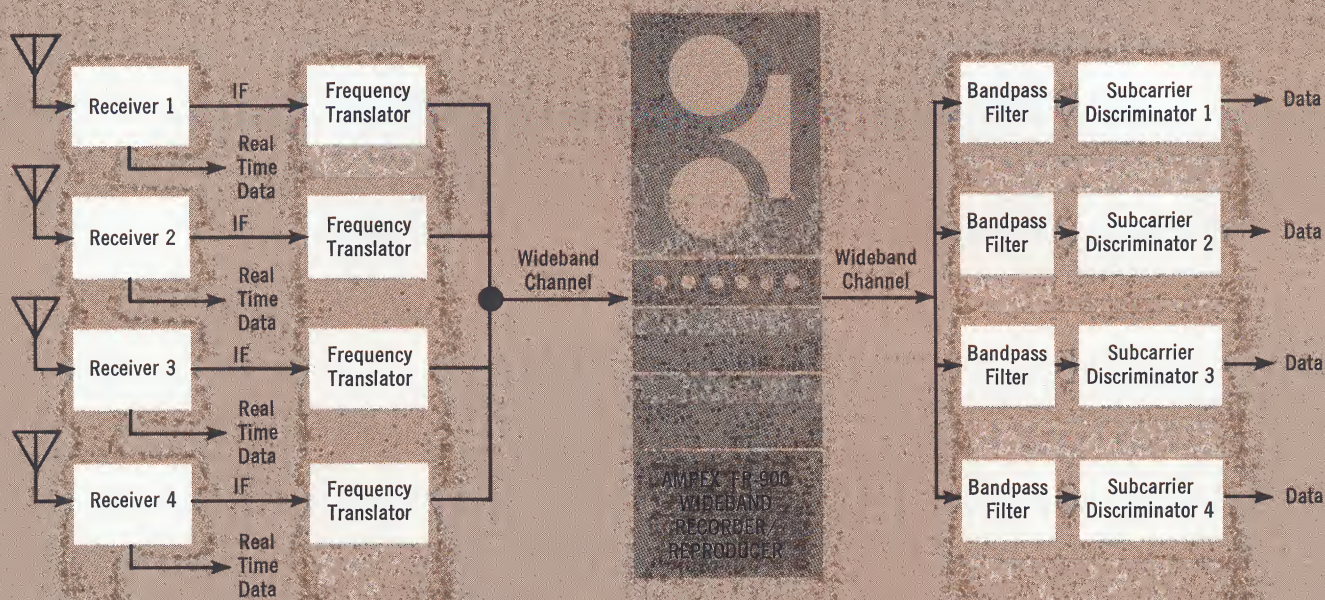
The FR-900 can record radar pulses less than $0.2 \mu\text{sec}$ in duration. Azimuth and elevation synchro information are multiplexed and recorded on auxiliary channel 1. Two voice channels and system timing information are multiplexed and recorded on auxiliary 2.



PREDETECTION RECORDING

The FR-900 can record data prior to detection at an IF rate. The upstream recording provided by the predetection concept increases reliability, provides excellent fidelity and can handle most types of telemetry formats. Standard IRIG telemetry data can be recorded and reproduced with exceptionally low flutter modulation.

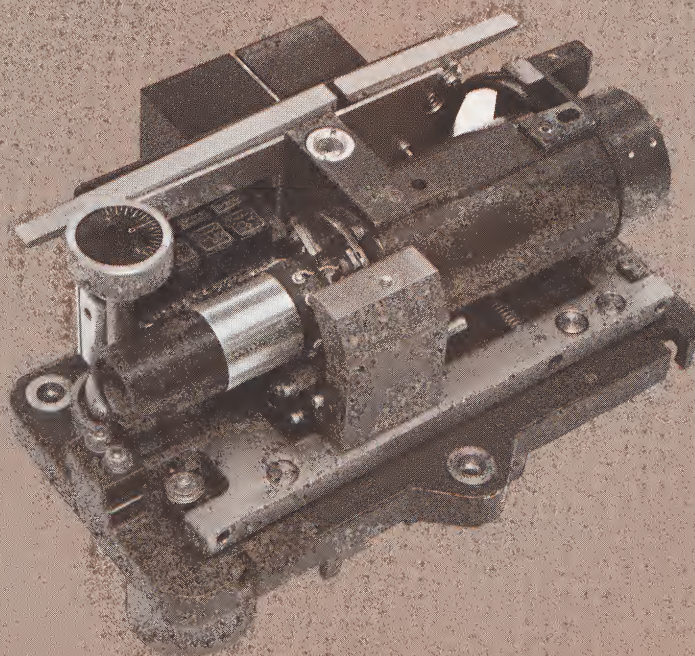
FR-900 APPLICATIONS



FREQUENCY MULTIPLEXING

The FR-900 can record up to four IRIG telemetry channels on a single wideband channel with one hour recording time. Information is reproduced with extremely low timing error and absence of switching transients.

FR-900 HEAD



Producing a 5.5 Mc bandwidth with transient-free operation, this Ampex rotary head is primarily responsible for the FR-900's outstanding performance. Cylinder at left is the rotary transformer; in back of it is the tip engagement adjustment.

HEADS AND ELECTRONICS

Heads...

Rotary heads make possible the FR-900's wide bandwidth; Ampex's accuracy and precision of manufacture provides transient-free operation with maximum time-base stability. The rotary head is an Ampex product brought to perfection in this recorder.

Wideband data is recorded transversely on tracks 10 mils wide and 15 mils on center. Four heads are mounted 90 degrees apart on the rotating drum. Two auxiliary channels record information longitudinally from 300 cps to 30 Kc and can be used to record audio information and timing signals. Special video and auxiliary multiplex equipment can be supplied on a custom basis.

Rotary Transformers

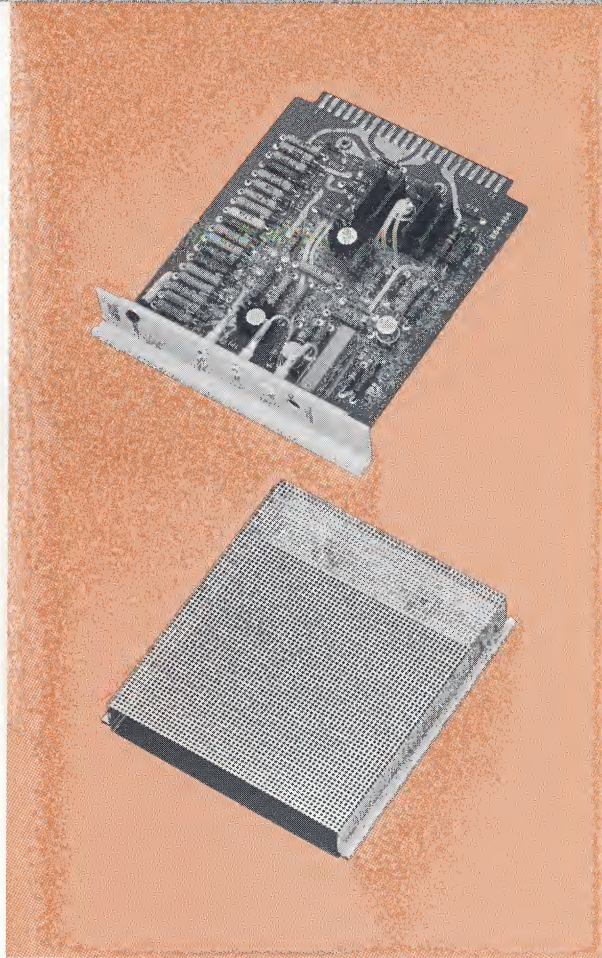
The head assembly utilizes long-life alfesil head tips and a recently developed low-noise rotary transformer for signal coupling to the heads. The transformers replace slip rings and eliminate slip ring noises which can look like radar pulses. The female guide servo has been eliminated for simpler, completely reliable operation.

The drum on which the heads are mounted is driven at a constant speed by a servo-controlled motor drive amplifier locked to a precise frequency standard. A control track insures that the heads will always lock accurately on the proper transverse track during the reproduce function.

Electronics...

Modular, All Solid-State

Wideband data is recorded on the tape by frequency modulation. FM effectively captures a greater number of octaves on a single channel. The limiting action of the FM system provides a means of eliminating signal amplitude variations.



Typical FR-900 all solid-state electronics card and cover.

Two auxiliary audio tracks are recorded longitudinally along one edge of the tape. A built-in microphone and speaker operating from one of the two tracks can be used by the operator during record/playback and calibration.

Solid-state components and etched circuit boards are used throughout the system for minimum bulk and maximum reliability. The electronics card rack contains modulator/demodulator, equalization and time-base correction electronics with their power supplies.

The entire FR-900 system mounts in a single rack cabinet. It operates on standard input power sources, 117 volts single phase, 50 or 60 cps AC. Tapes recorded on any machine, 50 or 60 cps, will play back on any other FR-900, without change in performance.

A specially plated glass dust cover, head cover and extra screening prevent radio frequency interference in accordance with Mil-I-26600, Class II.

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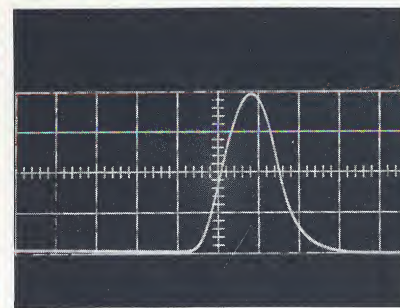
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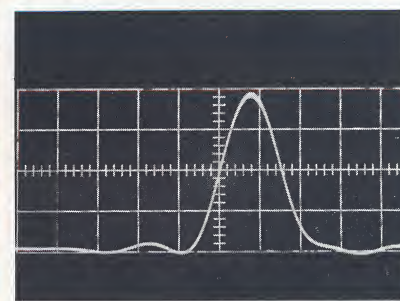
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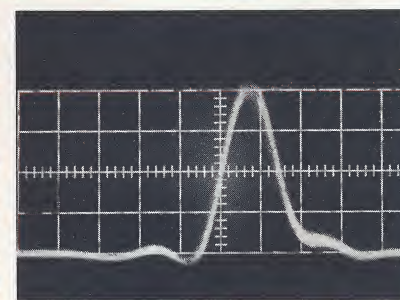
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150 NANOSECOND PULSE



ELECTRONICS TO ELECTRONICS

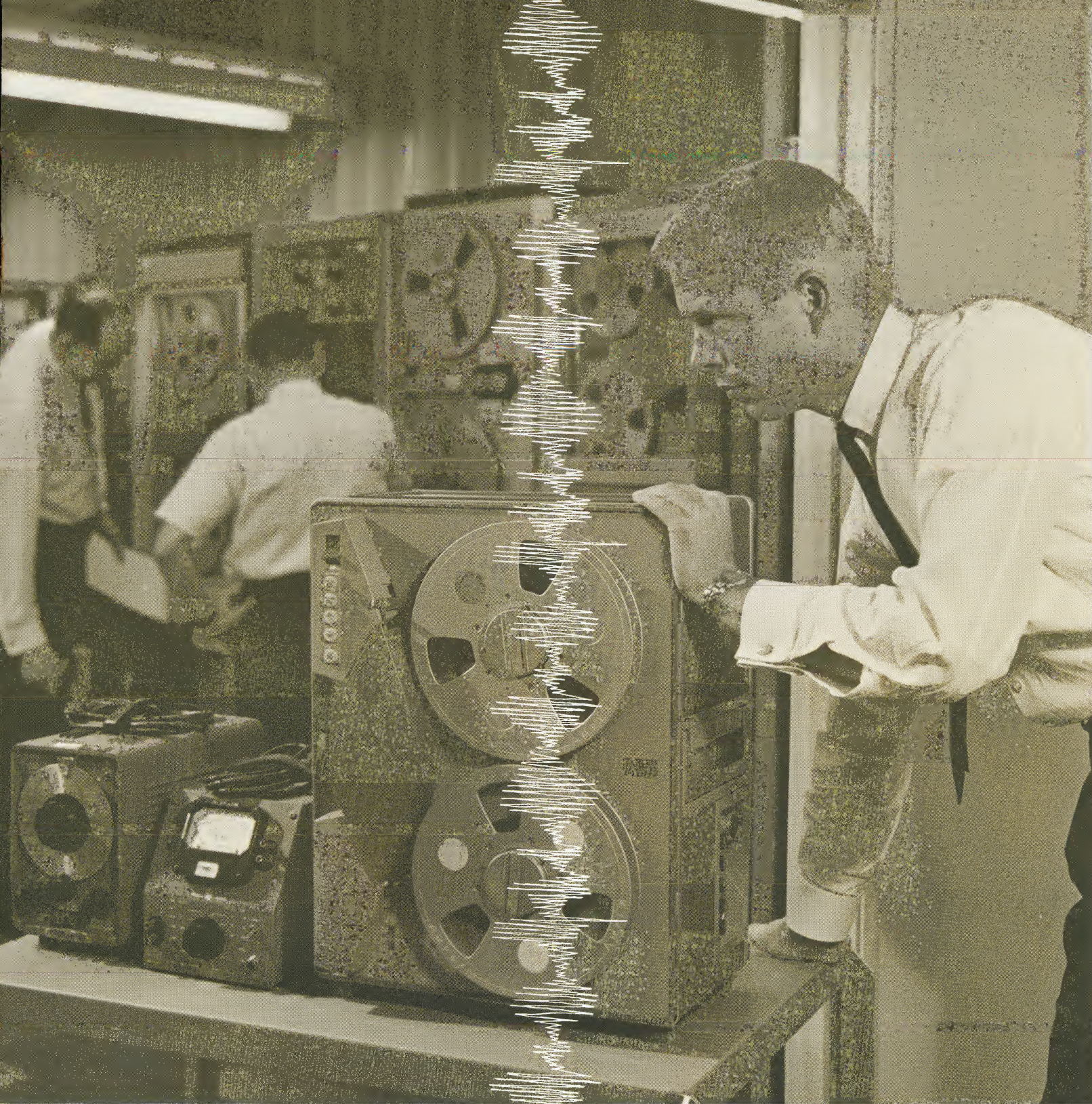


OUTPUT (OFF TAPE)

Typical photos of waveforms from an FR-900 demonstrate low preshoot and overshoot, low amplitude variation off tape and outstanding pulse fidelity. The oscilloscope photos are of a 150 nanosecond pulse, the minimum pulse width capability of the FR-900. Horizontal sweep rate is 100 nanoseconds/cm and vertical amplitude is 0.25 volts/cm.

AMPEX

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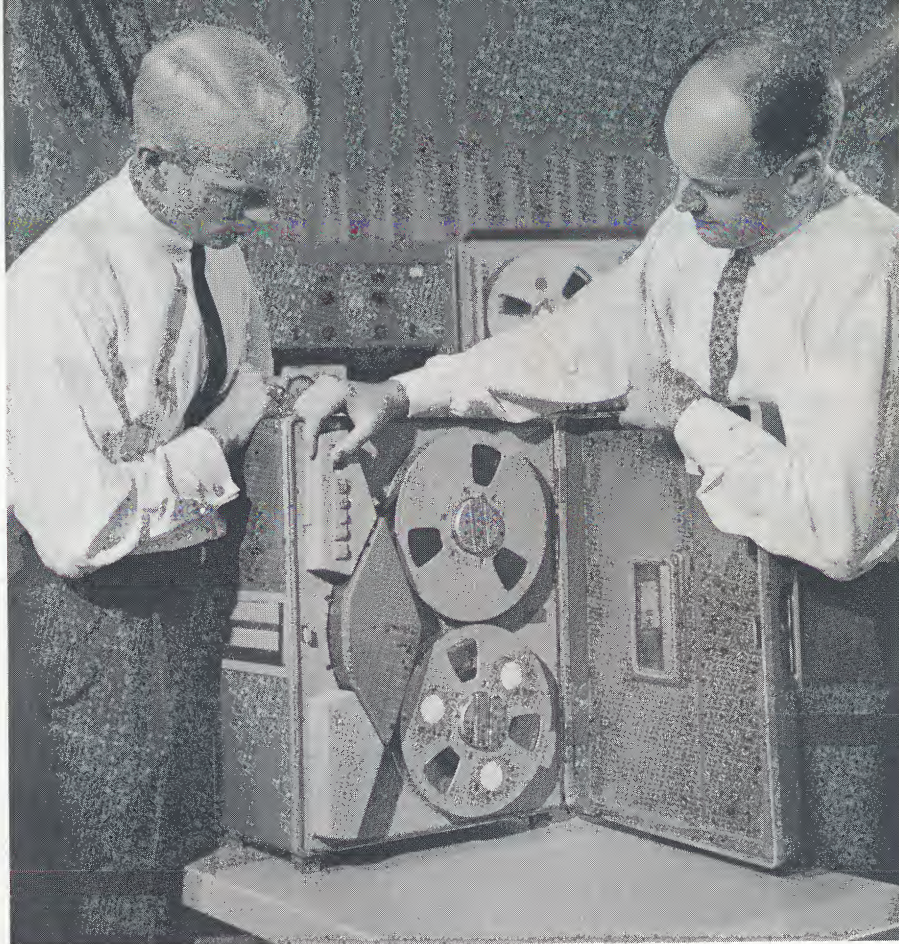


AMPEX

FR-1300

Portable Instrumentation Recorder

A new portable recorder from Ampex—The smallest portable instrumentation recorder offering full 14-track capability with 300 KC on Direct and 20 KC on FM.



the **AMPEX FR-1300**

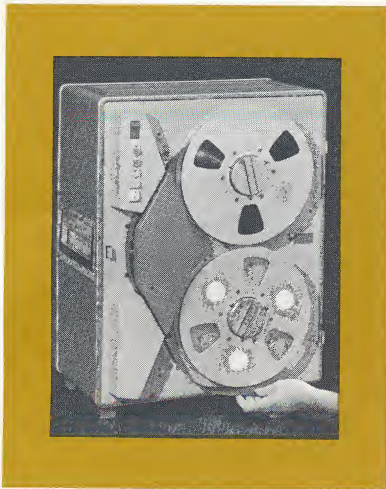
*A new standard for portable
recorders—true instrumentation
performance with 300 KC
on Direct and 20 KC on FM.*

The AMPEX FR-1300 is a completely new recorder featuring reliability and simplicity, plus ease of operation and maintenance. Under development and test for nearly three years, it represents a refinement and simplification of proven design techniques based on Ampex's accumulated experience as the largest manufacturer of precision recorders and memory devices.

Fully tested components, combined with sophisticated packaging, make the FR-1300 equally valuable for field, lab or portable use. It can be counted on to perform reliably under a wide variety of operating conditions, and with non-technical personnel. Easily moved from job to job, the FR-1300 can be handled as a standard piece of laboratory equipment, such as a signal generator, meter or oscilloscope. Check the features of this new Ampex portable to see how easily it can answer your instrumentation recording needs.

Features

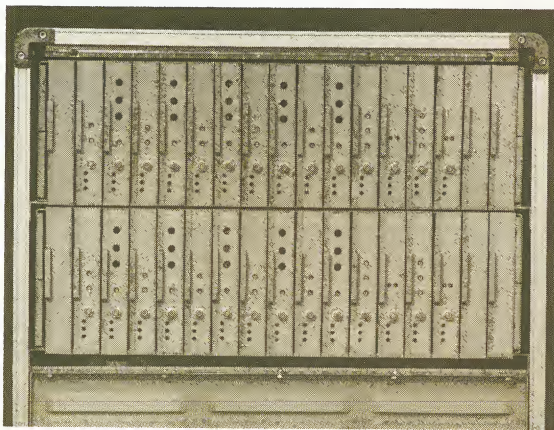
- A true portable measuring only 24x18x12½ inches and weighing only 110 pounds, for complete 14-track system.
- Unique capstan drive system insures speed accuracy.
- Electrically switchable speed change—no belts used.
- Full 14-track capability in a single portable case.
- All solid-state electronics.
- Straight-line tape path for foolproof threading.
- Tape lifters for increased head life.
- Controls interlocked to safeguard tape.
- Improved flutter.
- Conveniently located signal connectors and controls.
- Plug-in IRIG compatible heads.
- Available in rack-mounted version.



The FR-1300 simplified tape threading path insures foolproof operation even by non-technical personnel, while providing flutter and tape handling characteristics comparable to more complex drive systems.



The capstan speed servo meter which indicates phase relationship between the precise reference frequency and the capstan tachometer. This meter gives a positive indication that the capstan is rotating at the proper speed, and that the servo is locked to the reference frequency. Note the small window which indicates the tape speed and the screw-driver control to the right which is used for selecting speed. The speed indicator is color coded to match the amplifier plug-in equalizers and filters.



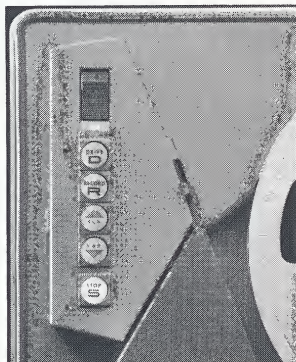
Rear view of the FR-1300 portable case, showing a full 14-track record/reproduce system housed in two electronics module files.

- **TRANSPORT — Compact Design for Long-Term Reliability**
 The FR-1300 transport is a completely new design based on refinements and recent improvements in components that sets a new standard for ease of operation and long-term reliability in portable instrumentation recorders. Ruggedness, plus precision, are apparent in the highly stable yet lightweight magnesium transport casting.
 Overall excellence of FR-1300 system design is well demonstrated by its superior tape handling characteristics. Braking is smooth and gentle, and is factory adjusted for the life of the recorder: no further adjustment is required during operation, set up or maintenance procedures. Another example of the well engineered design is the completely interlocked control circuitry (see illustration).
- **Unique Capstan Drive for High Accuracy Speed Control**
 The FR-1300 transport incorporates an integral capstan-speed servo system which continuously samples both frequency and phase of the capstan tachometer and compares them with a precise crystal controlled oscillator or line frequency. The output is used to provide extremely accurate speed control of the capstan. This new system uses precision AC motors instead of DC motors with their attendant commutator, slip-ring, brush and other replacement problems. A front panel meter (see illustration) provides visual monitoring of servo operation. As a further bonus, this drive eliminates the need for a separate motor drive amplifier.
 Six tape speeds are offered, 1½ to 60 ips, all electrically switchable from a single front panel control. No belt changes are required when switching to any of the FR-1300's six speeds.
- **Simplified Tape Threading Plus Tape Lifters**
 Tape threading is a simple straightforward line through slots in the head covers, across the heads to the take-up reel. Flutter and wow characteristics, however, are comparable to those obtained with far more costly and complex drive systems. In the fast forward and rewind modes, tape lifters raise the tape from the heads, contributing significantly to increased head and tape life. Lifters can be defeated to allow high speed search.
- **Constant Tape Tensioning for Accurate Data Reproduction**
 To obtain accurate results from tapes recorded under a variety of adverse conditions, holdback tension is controlled throughout the entire length of the reel to assure uniform head-to-tape contact during recording and reproduction.
- **HEADS — Plug-In IRIG Compatible**
- **ELECTRONICS — Solid-State, Interchangeable with FR-100C and Other Ampex Models**
 In keeping with the portable design concept of the FR-1300, a full 14-track record/reproduce system can be contained in the same portable case with the transport, power supplies, capstan servo and cooling fan. Input and output signal connectors are conveniently located on the top of the recorder for ease of accessibility from the front, side or back of the recorder. Signal connections can also be made through a connector on the front panel of each electronics module.
 Direct and FM electronics modules are available for the FR-1300 with performance to 300 KC on Direct and 20 KC on FM. These compact electronic amplifier modules measure only 4½ x 5½ x ¾ inch, and are electrically and mechanically shielded. Modules have molded front panels for easy removal from the card file. Each file accommodates up to 14 amplifier modules plus 3 auxiliary modules.
 Preamplifiers are used to minimize cable capacitance losses and noise pickup. These small, all-solid-state, plug-in cards are contained within the recorder case adjacent to the reproduce heads.
- **TAPE — Ampex 743 Recommended For Optimum Performance**

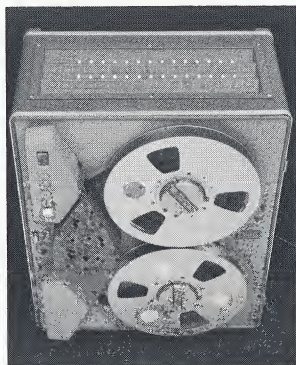
Other features of the FR-1300 Portable Instrumentation Recorder



The FR-1300 Portable shown here ready to move to its next job. Note the plastic-covered aluminum case and small openings which protect the transport, making this a truly utilitarian portable. The handles are a good example of the human engineering used throughout the FR-1300. They are designed to take the entire weight without strain, and are large enough for two-hand operation.



The FR-1300 control cluster. All controls are completely interlocked to positively prevent damage to tape regardless of sequence of control activation or even if more than one control is activated simultaneously.



Top view of the FR-1300 showing readily accessible signal connectors.

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